The Age Gap in Mortgage Access

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Research Question and Motivations

- What is the relationship between age and credit access?
- **Academics** – Little work has been done on the topic because of data limitations.
- **Policy** – Age is a protected class under U.S. lending laws. If age matters for credit access, then aging population may matter for:
  - Monetary policy efficacy.
  - Wealth accumulation via homeownership (e.g., first-time homebuying age).
  - Quality of life in retirement.

This Paper

- Munnell et al. (1996) use then state-of-the-art data set to document that race matters for mortgage access.
- **This paper aims to do the same for age.**
- Uses a large data set of mortgage applications to document conditional correlations between age and:
  - Rejection probability
  - Coupon rate
- Applicant age is associated with **HIGHER** rejection probability and coupon rate.
- Rejection probability result appears consistent with age-related mortality risk.
- Coupon rate result appears consistent with insufficient shopping.

Data Sets

- **Confidential Home Mortgage Data Act (cHMDA)** – Near-universe of U.S. mortgage applications from 2018 to 2022 with applicant age, other characteristics, and outcomes.
- **National Survey of Mortgage Originations (NSMO)** – Nationally representative survey data on borrowers that applied for and received mortgages between 2013 and 2020.
- **cHMDA-McDash-CRISM** – cHMDA merged with loan performance and credit bureau data. Mortgages originated from 2004 to 2019.

Samples

- Single-borrower, first lien, single-family, 30-year, fixed rate, **"vanilla"**, conforming, purchase and refinance mortgages.
- **Vanilla** refers to the lack of special features: interest-only, balloon payment, prepayment penalty, etc.
- **Conforming** – Mortgages that can be sold to Fannie Mae and Freddie Mac, "the GSES." By far, the majority of the residential mortgage market.

- **cHMDA** – 7.5 million mortgage applications.
- **NSMO** – 8.8 thousand surveyed mortgages.
- **cHMDA-McDash-CRISM** – 1.5 million mortgages.

Rejection

Rejection Regression Specification

$$100 \times \mathbb{1}(\textit{Rejected})_i = \alpha + \sum_{j=30s}^{J} \beta_j \times \mathbb{1}(\textit{Age Group } j)_i + \gamma' \mathbf{x}_i + \textit{Fixed Effects} + \epsilon_i.$$

- **i:** Index for loan application.
- **Age groups:** 18 to 29, 30 to 39, 40 to 49, 50 to 59, 60 to 69, and 70+.
- $\gamma' \mathbf{x}_i$**:** Vector of applicant and loan characteristics.
- **Applicant Characteristics:** Race, ethnicity, gender, credit score, and income.
- **Loan Characteristics:** LTV ratio, DTI ratio, loan amount, etc.
- Gives conditional correlation between age group and rejection probability.
- Suffers from omitted variable bias.

Rejection Probability Across Age Groups

	(1)	(2)	(3)	(4)	(5)
Outcome Variable	Actual Rejection	Actual Rejection	Actual Rejection	Actual Rejection	AUS Rejection
30 – 39	0.27***	0.27***		0.35***	0.12***
	[0.05]	[0.05]		[0.05]	[0.03]
40 – 49	0.81***	0.79***		0.87***	0.22***
	[0.11]	[0.08]		[0.08]	[0.04]
50 – 59	1.36***	1.20***		1.23***	0.24***
	[0.18]	[0.13]		[0.14]	[0.04]
60 – 69	1.81***	1.43***		1.44***	0.14
	[0.26]	[0.19]		[0.20]	[0.09]
70+	3.03***	2.29***		2.28***	0.03
	[0.50]	[0.41]		[0.41]	[0.17]
Hispanic	0.54***	0.62***	0.59***		0.16***
	[0.14]	[0.10]	[0.11]		[0.03]
Black	1.80***	1.43***	1.52***		0.39***
	[0.18]	[0.13]	[0.13]		[0.06]
Demographic Controls	Y	Y	Y	Y	Y
Application Characteristic Controls	Y	Y	Y	Y	Y
Tract × Year-Month × Loan Purpose FE	Y	Y	Y	Y	Y
Lender × Year-Month × Loan Purpose FE		Y	Y	Y	Y
AUS Control	Y	Y	Y	Y	
Observations	5,725,067	5,668,622	5,668,622	5,668,622	5,668,622
R-squared	0.38	0.46	0.46	0.46	0.47

- Older applicants face monotonically higher rejection rates.
- Age seems orthogonal to and as important as race and ethnicity.
- AUS results $\Rightarrow$ loan officers use additional information to make lending decisions wrt. age.

Potential Mechanism 1

- **Becker's (2010) taste-based discrimination**: Lenders require higher profit or return hurdle for discriminated groups. **Testable predictions**:
  - More competition leads to less discrimination.
  - Age effect should be larger in places with higher degree of age bias.
  - Fintech lenders are less likely to discriminate because they rely more on quantitative models and less on human decisions.

Indirect Test for Taste-Based Discrimination

	(1)	(2)	(3)	(4)
(30 – 39) × (Interaction Variable)	-0.01	0.01	-0.97	-0.19
	[0.01]	[0.02]	[1.40]	[0.12]
(40 – 49) × (Interaction Variable)	-0.02*	-0.04**	5.06***	0.04
	[0.01]	[0.02]	[1.81]	[0.22]
(50 – 59) × (Interaction Variable)	-0.02*	-0.02	10.27***	0.90***
	[0.01]	[0.03]	[2.30]	[0.22]
(60 – 69) × (Interaction Variable)	-0.05***	-0.07**	0.93	1.68***
	[0.01]	[0.03]	[2.86]	[0.51]
(70+) × (Interaction Variable)	-0.03	-0.11***	2.5	3.64***
	[0.02]	[0.04]	[4.05]	[1.21]
Interaction Variable	Tract HHI	County HHI	Age Bias	Fintech Lender
Demographic Controls	Y	Y	Y	Y
Application Characteristic Controls	Y	Y	Y	Y
Tract × Year-Month × Loan Purpose FE	Y	Y	Y	Y
Lender × Year-Month × Loan Purpose FE	Y	Y	Y	Y
Observations	5,668,622	5,668,622	5,666,972	5,668,622
R-squared	0.46	0.46	0.46	0.46

- Little evidence of taste-based discrimination in loan approval via these channels.

Potential Mechanism 2

- **Age-related mortality risk**: ECOA allows lenders to use age as a proxy variable if it matters for credit risk, i.e., age predicts death. **Testable predictions**:
  - Marginal increase in rejection probability is larger in old age.
  - Marginal increase in rejection probability is slower for female.
  - Age effect is larger for non-conforming mortgages; those that cannot be sold to Fannie Mae or Freddie Mac $\Rightarrow$ banks are exposed to more risk.

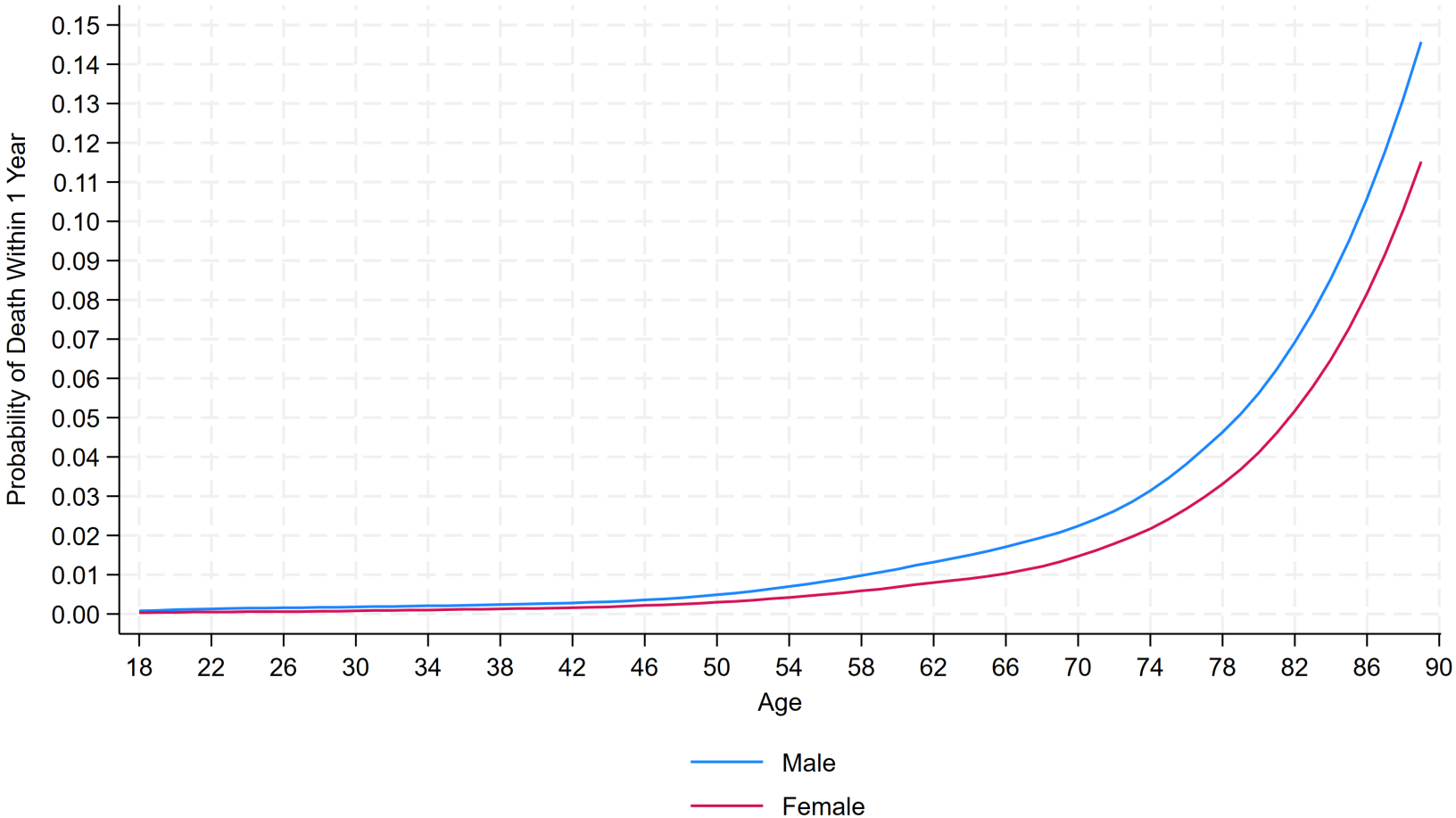
Equal Credit Opportunity Act – Exception for Age

- Regulation B implements the Equal Credit Opportunity Act (ECOA), which aims to "**promote the availability of credit to all creditworthy applicants without regard to** race, color, religion, national origin, sex, marital status, or **age** ... The regulation **prohibits creditor practices that discriminate on the basis of any of these factors.**

- "Creditor **may consider** the adequacy of any security offered when **the term of the credit extension exceeds the life expectancy of the applicant** and the cost of realizing on the collateral could exceed the applicant's equity."

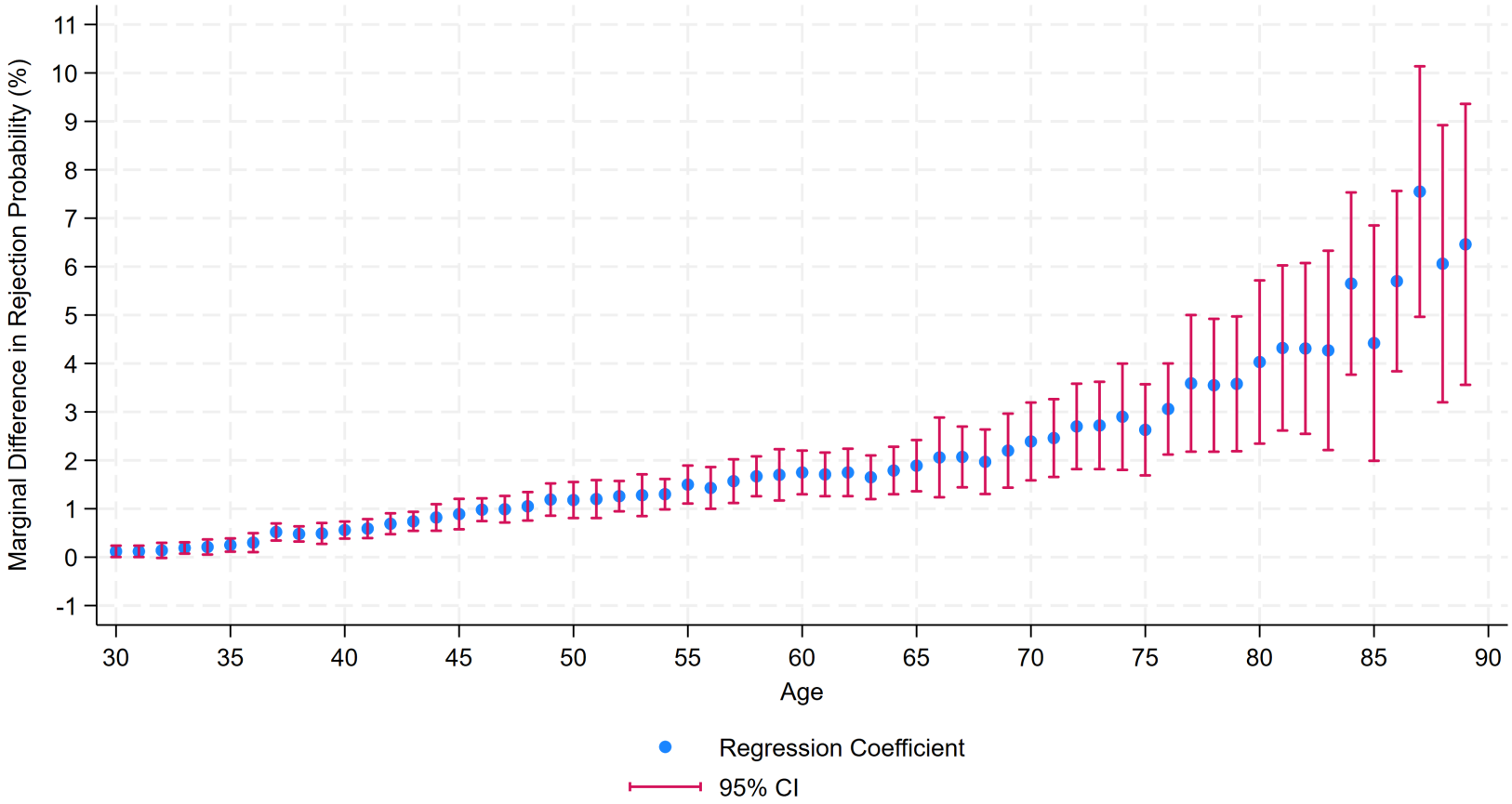
- $\Rightarrow$ Age may be considered if it matters for credit risk wrt. loan term.

Probability of Death in One Year by Age and Sex



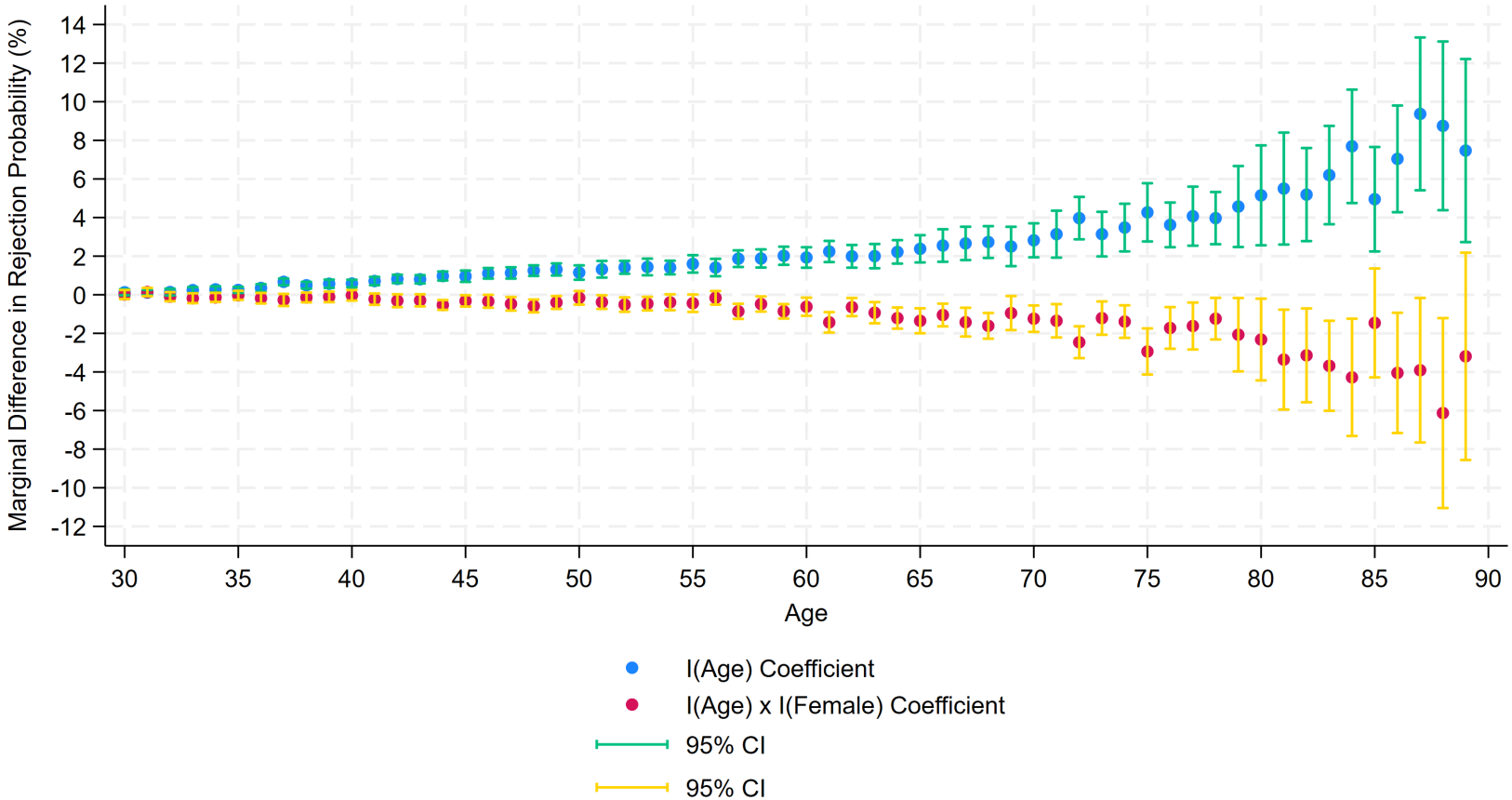
- Predictions 1 and 2 were motivated by this plot.

Rejection Probability by Age



- Rejection probability generally increases with age.
- Rejection probability increases faster for borrowers older than 70 years old.

Rejection Probability by Age and Sex



- Rejection probability increases slower for female borrowers.
- The male-female gap widens in old age.

Non-Conforming Loan Test

	(1)	(2)	(3)
	[2.30]	[2.14]	[1.95]
(30 – 39) × (Non-Conforming)	1.03	1.38	1.32
	[1.52]	[1.40]	[1.16]
(40 – 49) × (Non-Conforming)	3.50	3.83*	3.70**
	[2.22]	[1.97]	[1.61]
(50 – 59) × (Non-Conforming)	5.03**	5.17**	5.24***
	[2.48]	[2.19]	[1.83]
(60 – 69) × (Non-Conforming)	5.91*	5.94*	5.71**
	[3.40]	[3.11]	[2.63]
(70+) × (Non-Conforming)	6.16*	7.17**	6.51**
	[3.27]	[3.13]	[2.67]
Demographic Controls	Y	Y	Y
Application Characteristic Controls		Y	Y
Tract × Year-Month × Loan Purpose FE	Y	Y	Y
Lender × Year-Month × Loan Purpose FE			Y
Observations	5,810,535	5,809,400	5,753,020
R-squared	0.33	0.39	0.46

- Rejection probabilities are larger for non-conforming loans and increasing with age.

Other Mechanisms

- **Disparate impact from demographic-blind statistical models (e.g., ML) (Fuster et al., 2022)**: For example, race (Black/Hispanic) is strongly correlated with observable credit quality variables (e.g., credit score) and loan performance $\Rightarrow$ ML models that omit race would still give unfavorable outcomes for minorities. If true, same logic for age.

- **Omitted variable bias**: The regression does not control for unobservable credit risk, unrelated to age. **Example**: Standard life cycle logic predicts that old people should not carry debt $\Rightarrow$ financial distress in the sample may increase with age.

Coupon Rate

Loan-Level Pricing Adjustment (LLPA) Matrix

Table 1: All Eligible Loans – LLPA by Credit Score/LTV Ratio

Representative Credit Score	LTV Range (Applicable for all loans with terms greater than 15 years)									
	≤ 60.00%	60.01 – 70.00%	70.01 – 75.00%	75.01 – 80.00%	80.01 – 85.00%	85.01 – 90.00%	90.01 – 95.00%	95.01 – 97.00%	>97.00%	SFC
≥ 740	0.000%	0.250%	0.250%	0.500%	0.250%	0.250%	0.250%	0.750%	0.750%	N/A
720 – 739	0.000%	0.250%	0.500%	0.750%	0.500%	0.500%	0.500%	1.000%	1.000%	N/A
700 – 719	0.000%	0.500%	1.000%	1.250%	1.000%	1.000%	1.000%	1.500%	1.500%	N/A
680 – 699	0.000%	0.500%	1.250%	1.750%	1.500%	1.250%	1.250%	1.500%	1.500%	N/A
660 – 679	0.000%	1.000%	2.250%	2.750%	2.750%	2.250%	2.250%	2.250%	2.250%	N/A
640 – 659	0.500%	1.250%	2.750%	3.000%	3.250%	2.750%	2.750%	2.750%	2.750%	N/A
620 – 639	0.500%	1.500%	3.000%	3.000%	3.250%	3.250%	3.250%	3.500%	3.500%	N/A
< 620[1]	0.500%	1.500%	3.000%	3.000%	3.250%	3.250%	3.250%	3.750%	3.750%	N/A

- Conforming mortgages can be sold to the GSEs.
- The GSEs package the mortgages into MBSs and sell them to investors.
- The GSEs guarantee the mortgages in the MBS pool.
- **LLPA Matrix:** Credit score-LTV menu of guarantee fees (g-fee) that lenders pay to the GSEs upon sale.
- G-fees are quoted as percentage of loan amount.

Coupon Rate – LLPA Matrix Identification Strategy

$$\textit{Coupon Rate}_i = \alpha + \sum_{j=30s}^{J} \beta_j \times \mathbb{1}(\textit{Age Group } j)_i + \gamma' \mathbf{d}_i + \textit{Month} \times \textit{LLPA Matrix FE} + \epsilon_i.$$

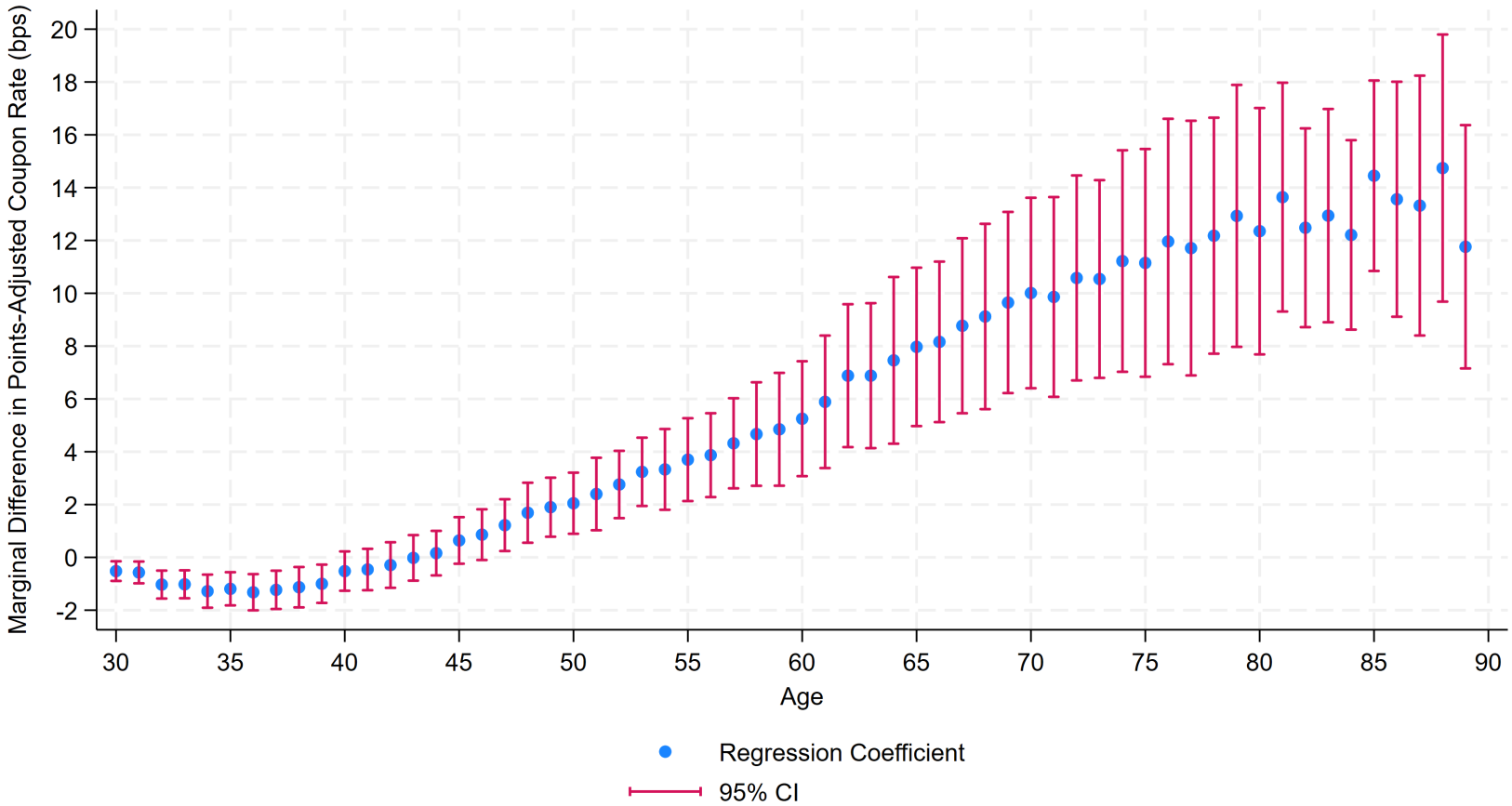
- Follows Bartlett et al. (2022)
- Sample includes mortgages originated and sold to the GSEs.
- **Assumption:** coupon rates on mortgages sold to the GSEs **should only** be determined by LLPA schedule.
- Loadings on age variables $\Rightarrow$ factors other than unobservable credit risk are at play.
- $\gamma' \mathbf{d}_i$**:** Vector of other applicant demographics (race, ethnicity, and sex).

Points-Adjusted Coupon Rate (bps)

	(1)	(2)	(3)	(4)	(5)
30 – 39	-1.00***	0.28	-1.39***	-1.30***	0.00
	[0.29]	[0.27]	[0.26]	[0.26]	[0.16]
40 – 49	0.45	2.04***	-0.26	-0.20	1.43***
	[0.44]	[0.53]	[0.24]	[0.23]	[0.22]
50 – 59	3.43***	4.06***	2.26***	2.18***	3.05***
	[0.77]	[0.90]	[0.34]	[0.31]	[0.50]
60 – 69	7.32***	6.61***	5.58***	5.38***	5.22***
	[1.46]	[1.45]	[0.89]	[0.85]	[0.96]
70+	11.12***	9.84***	8.95***	8.65***	8.00***
	[2.05]	[1.95]	[1.33]	[1.30]	[1.38]
Demographic Controls	Y	Y	Y	Y	Y
LLPA × Year-Month × Purchaser FE	Y	Y	Y	Y	Y
Tract FE		Y			
Lender FE			Y		
Lender × Year-Month FE				Y	
Lender × Tract FE					Y
Observations	3,986,126	3,981,755	3,986,047	3,976,695	3,016,617
R-squared	0.86	0.87	0.87	0.89	0.91

- Older applicants face higher points-adjusted coupon rates.
- Result not driven by sorting across lenders.
- Result holds with raw coupon rate as outcome variable.

Points-Adjusted Coupon Rate by Age



- Points-adjusted coupon rate generally increases with age.

Potential Mechanism 1

- **Becker's (2010) taste-based discrimination**: Lenders require higher profit or return hurdle for discriminated groups. **Testable predictions**:
  - More competition leads to less discrimination.
  - Age effect should be larger in places with higher degree of age bias.
  - Fintech lenders are less likely to discriminate because they rely more on models and less on human decisions.

Indirect Test for Taste-Based Discrimination

	(1)	(2)	(3)	(4)
(30 – 39) × (Interaction Variable)	0.01	0.04	-13.68***	-0.13
	[0.02]	[0.06]	[4.50]	[0.65]
(40 – 49) × (Interaction Variable)	0.00	0.01	-8.05	1.22
	[0.03]	[0.07]	[5.13]	[1.20]
(50 – 59) × (Interaction Variable)	-0.01	-0.09	6.21	3.50**
	[0.03]	[0.06]	[6.23]	[1.76]
(60 – 69) × (Interaction Variable)	0.00	-0.11	23.61***	6.42***
	[0.03]	[0.09]	[7.25]	[2.28]
(70+) × (Interaction Variable)	-0.10**	-0.25**	27.99***	8.60***
	[0.04]	[0.12]	[8.34]	[2.76]
Interaction Variable	Tract HHI	County HHI	Age Bias	Fintech Lender
Demographic Controls	Y	Y	Y	Y
LLPA × Year-Month × Purchaser FE	Y	Y	Y	Y
Lender × Tract FE	Y	Y	Y	Y
Observations	3,016,617	3,016,617	3,014,845	3,016,617
R-squared	0.91	0.91	0.91	0.91

- Little evidence of taste-based discrimination in points-adjusted coupon rate via these channels.

Potential Mechanism 2

- **Insufficient shopping**: Fewer competing offers $\Rightarrow$ higher interest rate and fees. **Testable predictions**:
  - Shopping intensity decreases with age.
  - Origination charges increase with age.

Age and Shopping Behavior

	(1)	(2)	(3)	(4)	(5)	(6)
	Considered > 1		Applied > 1		Better Terms	
30 – 39	1.6	0.1	-1.3	-0.8	-3.2	-2.4
	[2.5]	[2.5]	[2.3]	[2.4]	[2.6]	[2.6]
40 – 49	-1.9	-2.4	-8.0***	-6.3***	-3.1	-3.6
	[2.6]	[2.7]	[2.4]	[2.4]	[2.7]	[3.0]
50 – 59	-4.6*	-5.6**	-11.5***	-9.7***	-8.0**	-6.7*
	[2.7]	[2.8]	[2.3]	[2.5]	[3.1]	[3.5]
60 – 69	-8.6***	-8.0***	-12.2***	-9.6***	-6.7**	-7.0*
	[2.7]	[2.9]	[2.4]	[2.6]	[3.3]	[3.8]
70+	-12.6***	-12.2***	-12.2***	-10.1***	-10.9**	-16.8***
	[3.2]	[3.4]	[2.7]	[2.9]	[4.2]	[5.6]
Demographic Controls	Y	Y	Y	Y	Y	Y
Year-Quarter FE	Y	Y	Y	Y	Y	Y
Tract LMI Status FE	Y	Y	Y	Y	Y	Y
Survey Wave FE	Y	Y	Y	Y	Y	Y
Application Characteristic Controls		Y		Y		Y
Observations	8,805	8,744	8,805	8,744	2,007	1,907
R-squared	0.02	0.10	0.04	0.12	0.07	0.31

- Older borrowers are less likely to consider more than one lender and, conditional on applying to more than one lender, shop for better terms.

Age and Origination Charges (bps of Loan Amount)

	(1)	(2)	(3)	(4)
	Raw Origination Charges		Adjusted Origination Charges	
30 – 39	3.10***	2.33***	3.17***	2.54***
	[0.34]	[0.28]	[0.32]	[0.27]
40 – 49	4.31***	2.86***	5.26***	3.74***
	[0.77]	[0.69]	[0.77]	[0.61]
50 – 59	4.89***	3.38***	6.50***	4.54***
	[1.15]	[0.95]	[1.25]	[0.85]
60 – 69	7.35***	5.34***	9.53***	6.77***
	[1.82]	[1.44]	[2.05]	[1.31]
70+	9.67***	7.12***	12.10***	8.58***
	[2.57]	[2.04]	[2.95]	[1.88]
Demographic Controls	Y	Y	Y	Y
Application Characteristic Controls		Y		Y
Tract × Year-Month × Loan Purpose FE	Y	Y	Y	Y
Lender × Year-Month × Loan Purpose FE		Y		Y
Observations	5,147,192	5,091,430	5,147,192	5,091,430
R-squared	0.43	0.55	0.48	0.60

- Age is positively correlated with origination charge; consistent with insufficient shopping/bargaining.

Technology Aversion?

100 × 𝟙(Fintech Lender)	(1)	(2)
30 – 39	0.22	0.29**
	[0.22]	[0.14]
40 – 49	0.27	0.32
	[0.33]	[0.52]
50 – 59	0.80	1.26
	[0.91]	[1.18]
60 – 69	1.66	3.03
	[1.48]	[1.99]
70+	2.31	4.88
	[2.16]	[2.98]
Demographic Controls	Y	Y
Application Characteristic Controls		Y
Tract × Year-Month × Loan Purpose FE	Y	Y
Observations	5,726,204	5,725,067
R-squared	0.35	0.36

- Older borrowers are **NOT** less likely to apply for a mortgage with fintech lenders ⇒ technology aversion is unlikely to be a culprit of insufficient shopping.

Other Mechanisms

- **Omitted variable bias**: The identifying assumption of the LLPA matrix identification strategy may not hold. Loan officers use "additional" credit risk information in loan pricing (interest rate) decisions.

- **Rate-Points Menu Discrimination (Zhang and Willen, 2021)**: Minority (Black/Hispanic) applicants face rate-points menu discrimination; each discount point is worth less.

Conclusion

- Age is positively correlated with rejection probability, coupon rate, and fee.
- $\Rightarrow$ **Older individuals face higher barrier to mortgage access.**
- $\Rightarrow$ **Rejection probability, interest rate, and fee regressions should control for age.**
- Potential mechanisms: age-related mortality risk and insufficient shopping.
- $\Rightarrow$ **Age-related mortality risk channel implies weaker (loose) monetary policy transmission as population ages.**
- Many mechanisms can drive the documented facts so more research is required.